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THE 2K2M AND 2Zh2M TUBES

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The Type 2K2M and 2Zh2M pentodes are intended for battery-powered radios. The tubes of this series differ from their predecessors by their small dimensions (they are nicknamed "malgab" - small-size). They are used in a variety of battery sets; e.g. five out of six tubes in the mass-produced Rodina battery set are of this type.

Both pentodes have the same octal bases and their outward appearances are identical. The cathodes are made of thin wolfram wire coated with an oxide layer. The antidynatron grid  $G_2$  has no separate lead-out and is joined inside the tube to the end of the filament (prong 7). The control grid  $G_1$  is led out through a cap on top of the tube to reduce the plate-grid capacitance.

The side surface of the carbolite base and almost all the outer surface of the glass bulb are metallized, i.e. covered with a conducting layer consisting of very fine particles of copper. Where the bulb joins the base, the layer comes into contact with a wire encircling the tube and led out through prong 1. When prong 1 is connected to the receiver chassis, good static shielding of the tube electrodes is assured, as the copper layer has a low resistance (less than 10 ohms between the lead-out and any point on the layer).

The only difference between the 2K2M and 2Zh2M is the arrangement of the first grid. In high-frequency pentodes with a regulated transconductance characteristic, the grid is made with a varying-pitch winding. The pitch of the turns usually increases in the middle part of the grid and drops back to normal at the end. In the 2K2M pentode the increase in pitch is achieved by removing one turn in the middle of the grid. As a result, the curve showing the relationship between plate current and the voltage on the control grid (the grid characteristic) of the 2K2M pentode becomes elongated, which makes it suitable for circuits with automatic volume control.

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The grid of the 2Zh2M pentode has the same pitch throughout its length. As a result, its characteristic is shortened, and when the negative bias voltage is increased, the tube cuts off (sharp cut-off of plate current).

For the 2K2M and 2Zh2M pentodes the following limits on electrode voltages and plate power dissipation have been established:

Maximum plate voltage-160 volts; maximum screen grid voltage-90 volts; maximum plate power dissipation-0.5 watts. Typical tube conditions and parameters are shown in Table I (appended).

In operation, the filament voltage should be as near to the nominal as possible. Deviations which exceed  $\pm 0.2-0.25$  volts have a bad effect on the period of service of the cathode. For this reason it is desirable to use a rheostat or dropping resistor.

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The operational conditions of the 2K2M and 2Zh2M tubes can differ considerably from those given in the table, if it is necessary to economize on the plate battery supply. A working voltage of 60 volts or even 45 volts can be used, in which case the filament can be somewhat underheated without affecting tube life and, at the same time, the life of the filament battery will be increased. Of course, the reduction in plate voltage should be carried out carefully and is recommended only for tubes whose output is not more than a few milliwatts.

With 120 volts on the plate, 70 volts on the screen grid, 1.5 volts grid bias, and a load resistance of 100,000 ohms, the 2Zh2M pentode can deliver about 30 milliwatts. This power is quite sufficient with low noise level (the conditions of the countryside) to obtain loudspeaker reception. In this case, the total plate and screen grid current of the tube comes to about 1.3 milliamps.

In some cases it is necessary to use the 2Zh2M tube as a triode in which the screen grid  $G_2$  is used as a plate and the plate is used for diode detecting or is connected to the screen grid. In the latter case, the amplification factor is 16.

The best triode operating conditions are determined mainly by the output required and the voltage of the plate battery. The two conditions recommended in Table II (appended) refer to the cases where the tube is operating with an interstage transformer (Condition I) or headphones (Condition II). Under these conditions, the output power of the tube is 10 milliwatts.

From the foregoing data, it can be concluded that the 2K2M and 2Zh2M pentodes are quite up to date.

[Appended tables follow.]

Table I

<u>Voltages, Currents, and Parameters</u>	<u>Unit</u>	<u>2K2M</u>	<u>2Zh2M</u>
Filament voltage	Volts	2.0	2.0
Filament current	Milliamps	60	60
Plate voltage	Volts	120	120
Screen grid voltage	Volts	70	70
Control grid voltage	Volts	-0.5	-0.5
Plate current	Milliamps	1.9	1.7
Screen grid current	Milliamps	0.55	0.5

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Table I (Contd)

<u>Voltages, Currents, and Parameters</u>	<u>Unit</u>	<u>2K2M</u>	<u>2Zh2M</u>
Plate resistance (approx)	Megohms	1	1
Transconductance	Milliamps/volt	0.95	0.95
Transconductance when $E_{g1} = -10$ v	Milliamps/volt	0.025	-
Interelectrode capacitances:			
Input	Mmfd	5.2	5.2
Plate-grid	Mmfd	0.02	0.02
Output	Mmfd	8	8

Table II

<u>Voltages, Currents, and Parameters</u>	<u>Unit</u>	<u>Condi- tion I</u>	<u>Condi- tion II</u>
Plate voltage	Volts	45	60
Bias voltage	Volts	-1.0	-2.5
Plate current	Milliamps	0.8	0.5
Transconductance	Milliamps/volt	0.8	0.65
Plate resistance	Ohms	20,000	25,000
Plate load resistance	Ohms	2,000-4,000	100,000

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